Auctions in a Two-Sided Network: The Market for Meal Voucher Services

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Abstract

In two-sided networks, two parties interact on a platform, caring about the numbers of subjects on the other side. A typical problem, in this context, is setting prices for network services so as to get "both side on boards". The standard approach in the literature considers the network's ability to convince both sides to join the network, whereas this paper consider an alternative setting, in which one side determines the price balance.
This case is exemplified by the market for meal voucher services in Italy, in which one agency organizes the procurement of services for the public sector, through a competitive auction. A formal model of optimal auction is illustrated and used to assess the current procurement scheme. The model reveals that the current system is inefficient and could be improved through increased flexibility and adaptation to local economic conditions.

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1 Introduction

Two sided networks, markets or platforms, are defined as economic environments in which goods and services are sold to two distinct sets of customers that benefit from an increase in the number of users of the other set of consumers. Examples of two-sided networks are: payment systems, intermediation services, media, publishing software, portals, Internet search engines, telephone directories, scientific journals, and many others.

The key economic feature of these markets is the presence of bilateral network externalities: utility of agents on one side in an increasing function of the number of agents on the other side. For example, developers of software for videogame consoles care about the expected number of potential customers, that is, about the number of console owners. On the other hand, potential buyers consider the variety of software applications available.

A network can charge one side or the other, or both, to obtain revenues. Since the market volume on one side affects the agents' utility on the other side, agents care about prices, possibly negative, applied to *both* parties. In turn, total revenue, or profits, depends on the aggregate price level, as well as on the price structure. A correct price balance is essential to "get both sides on board"[1].

A much-studied case is the one of credit card networks. Credit cards typically charge sellers, through a "merchant discount" on the transaction price, as well as buyers, through transaction or membership fees. In cooperative credit cards associations, the price-balancing act is obtained by means of "interchange fees", paid by the merchant bank to the consumer bank. The setting of interchange fees by some bank associations has recently come under scrutiny by antitrust authorities in Europe, America and Australia[2]. Several renowned economists have contributed to the debate on these issues (Schmalensee (2002), Rochet and Tirole (2002), Wright (2003)).

Quite recently, a literature has spurred through the generalization of concepts emerged from the study of specific industries, like payment systems and media. This literature is aimed at establishing general theoretical principles for two-sided networks (Rochet and Tirole (2004)). Although the field is still very young , some interesting issues have already been successfully tackled, including: platform

[1] It is important to notice that this property derives from the impossibility of realizing a full pass-through of cost margins. This may be because of the existence of costs, which are independent from transaction volumes, or because of specific restrictions imposed by the networks (see, e.g., Gans and King (2003)).

[2] See, e.g., European Commission (2002), Reserve Bank of Australia (2002).

competition (Rochet and Tirole (2003), Guthrie and Wright (2003), Chackravorti and Roson (2004)), standardization (Schiff (2003)), negative externalities and dynamics (Caillaud and Jullien (2003)). However, much remains to be done. One aspect, which may be extremely relevant for some industries, is the possible presence of market power on one side.

The standard approach in the two-sided markets literature considers the network's ability to convince both sides to join the network. For example, network profits are maximized, conditional on the characteristics of the agents on the two sides, and possibly on the actions of competitor networks. Interacting parties (e.g., final consumers) remain relatively passive. Typically, an agent on one side can decide whether to join a network or not, and how much to consume. In some cases, agents are allowed to influence the other side choices, for example by refusing to join a platform so as to "steer" agents of the opposite side on the preferred network. In most of the models proposed in the literature, however, no agent can directly interfere with the process of price setting, and price balancing, performed at the network level. Like in a perfect competition model, the two (or more) market sides are price-takers, and do not enjoy any bargaining power.

Examples of this market power can be easily found in the real world, though. In the United States, credit cards are often associated with the brand name of some large customers, like big distribution chains or airlines. This association is the result of a specific commercial agreement, in which economic conditions are jointly determined. What makes these cases different from the basic monopsony or bilateral monopoly standard is the fact that the joining network member(s) do not aim at securing the service at the lowest possible price. Indeed, a lower price on one market side may imply a higher price on the other side, with negative effects due to the presence of network externalities. In some sense, the bargaining party internalizes the network-balancing problem with, however, potential divergences in the assessment of the correct balance.

Another interesting example is the procurement of meal voucher services in Italy. In Italy and other European countries[3], public and private companies provide meals for their employees through external restaurants, rather than offering internal catering. Independent networks typically undertake the service of linking restaurants and employers. These networks deliver "meal vouchers", of a specified amount, which can be spent by employees in some restaurants, displaying (as for credit cards) the network logo by the entrance.

These are typical two-sided networks. Indeed, these organizations get rev-

[3]This system is diffused in most European countries, particularly in Italy and France.

enues both from the restaurants (obtaining less than the sum specified in the vouchers) and possibly from the employers, which may pay more or less than the nominal amount. In the Italian public sector, an agency conducts auctions for the procurement of meal voucher services. Networks then compete by submitting bids, and the winner is the one offering the lowest percentage of cost coverage by the public entity. Network externalities are accounted for by setting "minimum quality requirements", in terms of number of restaurants accepting the voucher within a certain distance from the administration premises.

There is a clear trade-off between the minimum required diffusion level, and the expected cost reduction obtainable through a competitive auction. To convince more restaurants to accept the voucher, networks must keep the restaurant discount sufficiently low, compensating through higher prices charged to the employers. The interesting point here is that the balancing problem, typical of a two-sided market, is not faced by the network, but by one market side.

This paper address the issue of optimal design of a procurement auction for meal vouchers. The Italian market for meal voucher services is taken as an example of procurement of intermediation services or, more generally, of price setting in a two-sided market, in which one side has bargaining power.

The paper is organized as follows. The next section briefly describes the industry of meal voucher services in Italy. Next, a simple model of optimal auction design for the procurement of meal vouchers is introduced and discussed. Results obtained from the model are used in the subsequent section, to assess the current procurement procedure for the public sector in Italy. Finally, an ending section draws some conclusions and comments about possible generalizations of results.

2 The market for meal vouchers in Italy

In Italy, as well as in most other European countries, wage and working conditions are subject to negotiations between Trade Unions and Employers' Associations, at the national and local level. Collective contracts determine, among other things, how employees have their lunches in the workplaces.

Employees can carry their own food but, more frequently, employers have to provide for catering, especially in the medium-large firms and in the public sector. They can do so in two different ways: through internal restaurants (mense aziendali), or through agreements with outside restaurants, bars and supermarkets.

In this latter case, they can either set individual arrangements with the restaurants, or they can rely on the intermediation services of specialized networks.

These networks deliver meal vouchers, of various amounts (the level is agreed in the work contract, and normally varies from firm to firm).

Workers can then buy meals in specific restaurants, affiliated with one or more networks[4]. Acceptance of network-specific meal vouchers for payment is communicated through the display of the network logo, usually by means of stickers, put on the restaurant windows by the entrance.

This system is growing in popularity[5], also because it takes advantage of of some fiscal benefits[6]. Currently, the Italian market for meal vouchers is an oligopoly, where a few large firms operate, some of which are multinational enterprises, specialized in the services (Sodexho, Cheque Dejeuner), in hotels and restaurants (Accor), or in the catering industry (CAMST). The main network accounts for 45% of the market, whereas the first five groups cover more than 80%.

Public entities (municipalities, regional governments, universities, hospitals, etc.) are big buyers of meal vouchers for their employees. Currently, 400,000 public employees use meal vouchers, whereas users in the private sector are around 900,000. Up to a few years ago, each administration used to choose its own network, using the same procedures followed to select suppliers for various goods and services.

In trying to keep public expenditure under control, the Ministry of the Economy and Finance has recently introduced a new system of centralized procurement[7]. Here is how the system works. A specialized, Ministry-controlled agency (Consip) bargains with private firms the supply conditions for a wide range of goods and services, needed by the various public institutions. Sometimes, the "procurement franchising" is auctioned off, and fairly good economic conditions, like big quantity discounts, are obtained.

Any public entity, needing some goods or services, gets from the Internet[8] information about the possible existence of standard contracts, at the special conditions obtained by Consip. The only thing to do, to purchase the required services, is to adhere to a pre-existing contract format, when available[9].

[4]Employers select one network, restaurants can join any number of networks (even none). Networks are independent and separated.

[5]The total value of meal vouchers exchanged in Italy is estimated at 1400 millions Euros (FIPE (2004)), almost doubling the volume of just 6-7 years ago.

[6]Most notably, partial tax exemption and lower VAT rates. However, the main advantage is flexibility and the avoidance of capital immobilization.

[7]Also, national associations of private employers (Confidustria, API, etc.) have realized framework agreements with some networks, for their members.

[8]`http://www.acquistinretepa.it`.

[9]Goods and services can still be purchased independently, if the proposed items do not fit the

This system has been applied to the procurement of meal vouchers. Consip organized a set of competitive auctions, where networks competed for the right to supply meal vouchers to all public entities in a given territory (for two years)[10]. The winning bid was the one offering the highest discount on the nominal value of each voucher[11].

The interesting aspect here is how the mechanism of competitive auction has been adapted to this two-sided market. Of course, if networks could freely compete only on the public sector side, very generous discounts would have been compensated through expensive conditions for the restaurants. In turn, this may mean that very few restaurants would accept vouchers used by public employees.

In practice, this problem has been tackled by resorting to specific quality requirements. In any procurement auction, minimum quality standards may be specified. In this case, quality has been defined in terms of minimum number of accepting restaurants[12]. But, how these requirements should be set? How these requirements depend on external conditions, like supply density, transport costs, profit margins on the local market, etc.?

Fixing a large number of accepting restaurants implies getting less advantageous conditions from the competitive auction, and vice versa. In this way, one side of the two-sided network internalizes the typical problem of price balancing, usually faced by two-sided platforms.

In the next section, a model for the optimal determination of voucher discounts or, equivalently, of diffusion standards, will be introduced and discussed. Results from this model will then be used to assess the efficiency of the current procurement scheme.

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special needs of an administration.

[10] The introduction of competitive auctions has dramatically changed the market. Discounts applied to the restaurants have increased substantially, thereby reducing their profit margins. Protests have been organized by some industry associations, and even a strike, in the form of refusal of voucher acceptance for one day ("No ticket day", June 25th, 2003). Law proposals, regulating the market, are under discussion in the Parliament (FIPE (2004)). Some public workers' associations are protesting as well, arguing that it is getting more and more difficult to find restaurants, or that some of them apply a lower value to the vouchers.

[11] This means that the actual value of each voucher is left to be determined independently by each institution, on the basis of local agreements with trade unions. Results of an auction may indicate, for example, that the winning network will sell, to the administration, meal vouchers at a price, which will be a fraction (e.g., 85%) of the actual expenditure at the restaurant.

[12] Yet, one could argue that this has nothing to do with the service quality, in a strict sense.

3 A model of optimal auction for meal vouchers

Consider a set of restaurants, selling - for the sake of simplicity - one type of food, at a unit price p. Economic theory tells us that each restaurant would set its profit-maximizing price on the basis of the Lerner inverse-elasticity rule:

$$\frac{p-c}{p} = \frac{1}{\epsilon} \tag{1}$$

where c is the marginal production cost, supposedly constant, and ϵ is the individual, *perceived*, demand elasticity. It expresses the percentage of customers that a restaurant presumes to lose, if its price is increased by 1%, taking into account the possible (conjectured) reactions of the competitors. This formulation encompasses a wide variety of market structures: from very competitive ones (where ϵ would be very large) to local monopolies (where ϵ would be almost equivalent to the aggregate demand elasticity).

Marginal cost c depends on the local cost of food ingredients, labour and capital. Perceived elasticity ϵ, indicating how easy may be for a customer to switch from one restaurant to another, depends on the degree of product differentiation, on the geographical proximity of competitors (density of restaurants), and on the level of consumer knowledge about the existence of alternative suppliers.

Two elements are very important in the assessment of meal voucher services. The first is price: the higher the price, the lower will be the quantity of food that can be purchased with a voucher of a given value. The second one is the profit margin ($1/\epsilon$): since networks apply to the restaurant a charge, defined in terms of value percentage, only the restaurants having a margin larger than the percentage fee would find it profitable to accept some vouchers for payment.

We identify the relevant economic characteristics of restaurants in the bidimensional space of marginal costs and profit margins: each restaurant is associated to a point, whose coordinates express its specific cost and margin (Figure 1). The value of the minimum marginal cost is normalized to one.

Costs and profits are likely to be geographically correlated, as restaurants that are close to each other operate on the basis of similar economic conditions. For example, the level of tourism activity influences both production costs and profit margins: closely located restaurants will also be closely located in the space of economic characteristics. Vice versa, any movement in the space of characteristics implies a movement in the geographical space[13].

[13] In general, the two movements will not be proportional and they will be direction-dependent.

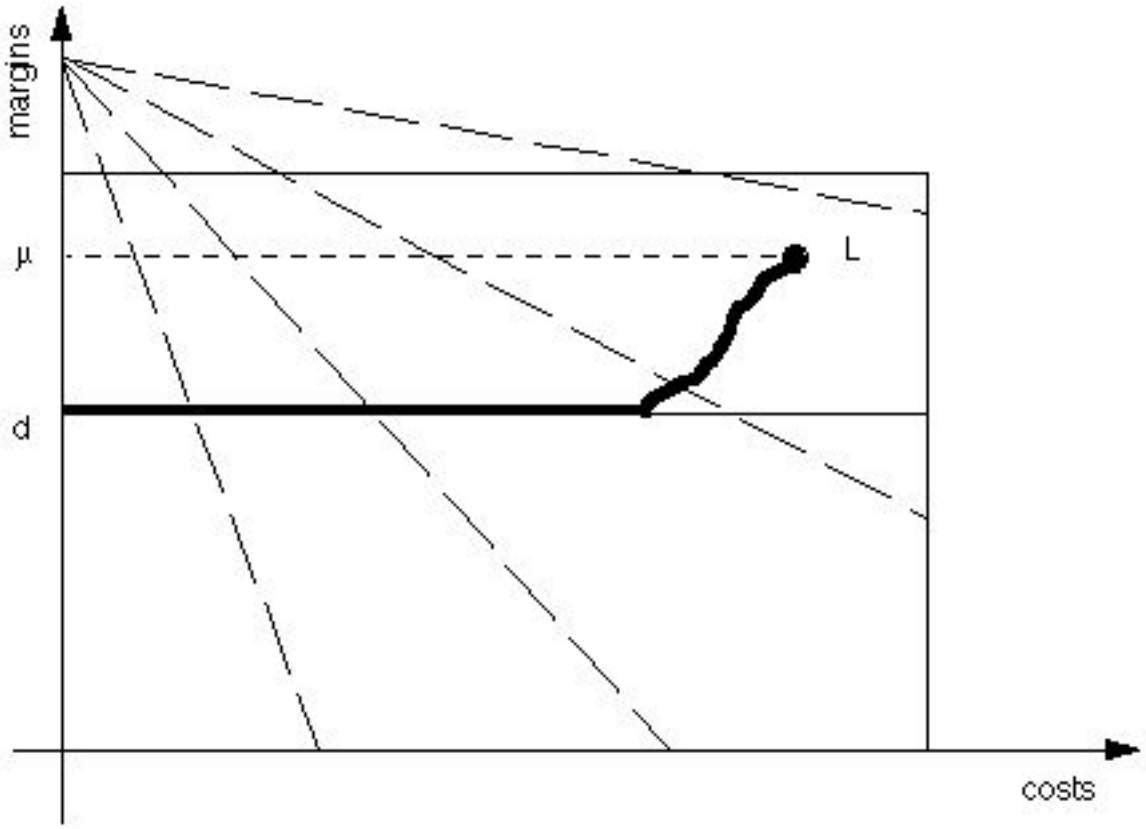

Figure 1: Consumers and restaurants in the costs/margins space.

Let us consider now a specific restaurant, being the closest to a certain workplace (distance zero). This is identified in figure 1 with the point L. Workers from this workplace can buy meals there, without moving, at the price determined by its combination of cost and margin.

Alternatively, workers may seek cheaper alternatives, characterized by lower unitary profits and/or lower production costs. In figure 1, dotted downward lines identify cost/margin combinations associated with the same price level. Minimization of transportation costs for all possible price levels gives raise to an optimal search path, to the left and below of the point L[14].

Suppose that, for vouchers used by the workers, a percentage discount d on the value of the meal is applied. Since these vouchers will only be accepted by

[14]In the figure, this is traced as a continuous thick curve. However, nothing ensure here continuity of the optimal search path in the space of characteristics.

restaurants having profit margins larger than d, workers will find accepting restaurants only in the upper part of the rectangle of figure 1. When the search path meets the horizontal line at d, lower prices can only be obtained from restaurants with lower production costs, which are found to the left.

The minimum price, or, equivalently, the maximum quantity of food that can be purchased with a fixed-value voucher, is found where the profit margin is d (meaning that the restaurant achieves no net profit after paying the network), and the marginal cost is lowest (1). However, workers will not necessarily select that that point, as any movement along the search path increases transportation costs. In an internal optimum, the marginal transport cost would equalize the marginal utility of consumption.

Setting a higher d means reducing the number of accepting restaurants. With less restaurants available, workers end up by paying more, thereby getting less food. In other words, there is a trade-off between workers' utility and network revenues.

It is easy to see that, if d has been optimally determined, workers must choose a restaurant, having exactly that minimum profit margin d (on the flat part of the search path). Indeed, if this would not be the case, it would be possible to increase network revenues without affecting the workers' utility. This implies that, with an optimal discount level, transportation costs depend only on the absolute difference between d and the profit margin at the initial point L (μ).

For the setting of the restaurant discount d, we imagine the following mechanism. A meal budget b is agreed by employers and employees. A perfectly competitive auction is subsequently organized for the procurement of vouchers, where networks submit bids in terms of employer discounts on the voucher value (r). In other words, each time a meal voucher is used, the franchised network pays a "royalty" rb to the employer. The network offering the higher discount gets the procurement contract.

There are many competing networks participating to the auction, there are no informational asymmetries or collusive behavior[15]. As a consequence, the winning network makes no profits and the employer extracts all network revenues: $db = rb + g$, where g stands for network transaction costs. Without loss of generality, let us assume $g = 0$, which implies $d = r$.

[15] In reality, auctions may be affected by a variety of factors, facilitating the persistence of equilibrium profits for the winning bidder. For the sake of simplicity, we abstract here from all these factors, which are extensively studied in auction theory.

A quality standard is imposed for network services, in terms of minimum number of accepting restaurants. This number is inversely related to the applied restaurant discount d. Since networks have incentives to set high discounts, because this translates into higher bids in the auction, the quality constraint will be binding in equilibrium. In turn, this implies that, in a perfectly competitive auction, the auctioneer can predetermine the discount d applied by the franchised network.

The target discount level is cooperatively determined by employer and employees, in a settlement where workers' utility is balanced against employer expenditure. Workers' utility itself includes two components: consumption utility and transportation costs.

Let us specify the latter in a simple way, as follows:

$$T(d) = t(d - \mu)^2 \tag{2}$$

where t is a fixed cost parameter.

For consumption utility, let us also adopt a very simple, constant marginal utility specification:

$$V(q) = aq \tag{3}$$

where q is the quantity of food consumed in the meal.

To see the relationship between $V(q)$ and d, let us suppose that transportation costs are sufficiently low, so that the workers always select the cheapest restaurant for all values of d. In this case:

$$c = 1 \Rightarrow p = \frac{1}{1-d} \Rightarrow q = \frac{b}{p} = b(1-d) \Rightarrow V(q) = ab(1-d) \tag{4}$$

For the determination of the discount d, it can be assumed that a weighted sum (U) of workers utility and employer net revenue is maximized, where ω is the weight, measuring the bargaining power of the employer in the cooperative agreement, associated with the latter component:

$$U(d) = V(q) - T(d) + \omega(rb - b) = ab(1-d) - t(d-\mu)^2 + \omega b(d-1) \tag{5}$$

The objective function U is strictly concave, so it is maximized at a single point d^*. However, for the solution to make economic sense, d^* must be comprised between the minimum and the maximum profit margin existing in the market. If d^* equals the maximum margin, we get a trivial corner solution, in which

no restaurant accepts the meal vouchers, and the whole budget remains in the employer's pockets.

For the more interesting case, in which meal services are actually delivered, straightforward computations show that:

Proposition 1 *When meal voucher services are outsourced, by means of a competitive auction, in which diffusion standards are set in such a way that (5) is maximized, the franchised network either sets the discount d at the highest level ensuring complete voucher acceptability (by all restaurants), or at a higher level:*

$$d = \mu + \frac{b(\omega - a)}{2t}$$

This proposition states that the following factors call for a high discount or, equivalently, for low diffusion requirements in the competitive auction:

- High profit margins in the proximity of the workplace. This may mean that the workplace is located in an area in which competition among restaurants is weak, and demand is inelastic (possibly because of additional demand generated by tourists[16]).
- High employer weight in the cooperative agreement, relative to the marginal utility of consumption by employees. This effect is more significant, the bigger the budget at hand.
- Low transportation costs, possibly due to high density of restaurants, efficient transport systems, or long lunch breaks.

4 The current procurement scheme for the public sector in Italy

In the most recent auction set up by the Consip agency, Italy has been divided in five macro-regions. Meal voucher networks submitted bids, specified in terms of employer discount on the nominal value of each voucher.

Winning networks have agreed to accept orders coming from any public entity in a region, for vouchers of a variable value, up to a maximum amount, or up to

[16] On average, meal vouchers account for 16-18% of total revenues for restaurants and similar businesses (FIPE (2004)), but in a few cases this share may reach as much as 80%.

a maximum total number of vouchers. After receiving a supply request[17], the franchised network must ensure that a sufficient number of restaurants (or similar businesses) accept meal vouchers of the network. These restaurants (at least 1/15 of the employees having right to the vouchers) must be found at a distance lower than 1 Km. from the workplace[18].

Table 1 summarizes the outcome of the last auction round, displaying, for each region, the winning network and the highest employer discount bid.

Region	Max.Amount	Network	Emp.Discount
North-West	149	Buonchef	16.21%
North-East	95	Buonchef	16.21%
Center	150	Ticket Restaurant	15.93%
South-East	135	Repas Lunch Coupon	16.89%
South & Islands	106	Sodexho Pass	16.29%

Tab.1 - Result of the last procurement auction[19]

As can be easily seen, there is little variability among the winning bids. Futhermore, differences between bids can hardly been explained in terms of the causal factors pinpointed in the theoretical model.

Apart from possible non-competitive features of the auction, the main reason is quite evident: the regions, in which Italy has been subdivided, are very large, as each includes small towns, rural and metropolitan areas, industrial and touristic zones. Therefore, the bids could be interpreted as a sort of averaging of quite different local economic conditions[20].

Another characteristic of the procurement contract, which is difficult to interpret here, is the requirement that the number of accepting restaurants must be larger the bigger (in terms of employees) is the public entity demanding the supply of meal vouchers. However, notice that the region Center, in which the capital Rome is located (with big institutions, like Ministries and Government offices) has the lowest employer discount, suggesting that economic conditions for restaurants would be better there, and vouchers would be more diffused.

[17] Within 20 days from the reception of the first order.

[18] Computed on the basis of the shortest walking path.

[19] Amounts in millions Euros.

[20] Usually, networks apply to the restaurants a discount of around 10% on the meal value, which amounts to 18% after VAT has been deducted (as it is in the bids displayed on table 1). Therefore, there is a bottom line of around 18% for the auction bids. Networks get revenues around 1-2% of the voucher value. Would the auction be perfectly competitive, these revenues would just allow the networks to break even.

Overall, the analysis conducted so far reveals that the whole procurement mechanism for meal vouchers in the Italian public sector is quite inefficient. Better results could be achieved by introducing more flexibility into the scheme, making the system adjustable to the local economic conditions.

Adopting a finer spatial grid may not help, though. On one hand, this would increase the transaction costs for the auction. Furthermore, the procurement agency should fine-tune the diffusion requirements for each micro-region. Instead, networks should be allowed to submit bids in two dimensions: employer discount and local degree of diffusion (or restaurant discount). The different bids could then be ranked, using a suitably designed index, specified as an increasing function of both the employer discount and the number of accepting restaurants. This index would then allow some degree of substitution between the two elements, because it should be built to reflect the utility, or objective function, of the public institution[21].

The main advantage of this solution is overcoming the informational asymmetry between the auctioneer and the bidders. After all, this is what the auctions are made for. By construction, public institutions would then select the network providing the highest level of utility (whatever defined), conditional on the existence of non-negative network profits[22]. Setting diffusion or minimum quality standards would not be a worry anymore.

5 Conclusion

Price balancing is a key feature in all two-sided networks. Media like TVs and radios, for example, set prices for advertisers and viewers/listeners. Intermediaries decide whether to charge sellers or buyers. Credit cards apply fees to merchants and consumers. In this sense, there is nothing special about meal voucher networks, since - as all other two-sided networks - they can rely on two distinct sources of revenue: the restaurants and the employers.

The recent literature on two-sided markets has shown that, for a profit-maximizing network, the optimal price structure depends on a variety of factors: demand

[21] An additional difficulty here is given by the fact that the auction is conducted indirectly by an external agency, for all public entities. This could be overcome, by selecting in the auction a menu of alternative economic conditions, from where each administration chooses its preferred combination, associated to one specific supplier network.

[22] This result is reminiscent of that of a Bertrand price war between two networks, selling identical services to one "single-homing" market side (see, e.g., Chackravorti and Roson (2004)).

elasticities, sensitivity to network externalities, intensity of competition between platforms.

In this respect, the industry of meal vouchers has a noticeable characteristic. When competitive auctions are organized, the problem of price balancing ceased to be a problem for the network, and becomes a problem for one market side (the auctioneer).

In principle, there is a direct (inverse) relationship between prices applied to the two sides, when the level of network profits is given (e.g., zero). If the auctioneer sets the price for one side, then the other price could be indirectly fixed through an auction. However, this requires that the auctioneer knows what the optimal structure is, in the first place.

The simple theoretical model illustrated in this paper has shown that the optimal price structure for meal vouchers depends on specific parameters: local profit margins, transportation costs, relative bargaining power of employer and employees. It is doubtful, however, that an auctioneer has all the necessary information to correctly identify the optimal price structure in all circumstances. A much more efficient solution would then be given by an auction, conducted with two instruments, in which networks submit bids in terms of prices applicable to the two sides.

In this paper, we illustrated and commented the current procurement system of meal vouchers for the public sector in Italy, arguing about its inefficiency. In this scheme, voucher diffusion requirements have been interpreted as minimum quality standards, rigidly set and equal for all regions[23]. By contrast, we pointed out that these parameters should be conceived as decision variables, to be flexibly adjusted to the local economic conditions.

[23]This may be seen as just another example of misconception about the mechanism of price balancing in two-sided markets. Other known cases are: the interchange fee set in the credit card industry, which has been - wrongly - interpreted as a price for inter-bank services (Schmalensee (2002)), and the installed base of customers on one side, which has been - wrongly - interpreted as a barrier to entry (Evans (2003)).

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